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(71) Applicant *(for all designated States except US)*: **BENTLE PRODUCTS AG** [CH/CH]; Oberneuhofstrasse 5, CH-6341 Baar (CH).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **AHM, Poul, Henrik** [DK/ES]; Edf. Mar Bella, Atico A, 43, Calle San Pedro, E-03590 Altea (ES).

(74) Agent: **CHAS.HUDE A/S**; H.C. Andersens Boulevard 33, DK-1780 Copenhagen V (DK).

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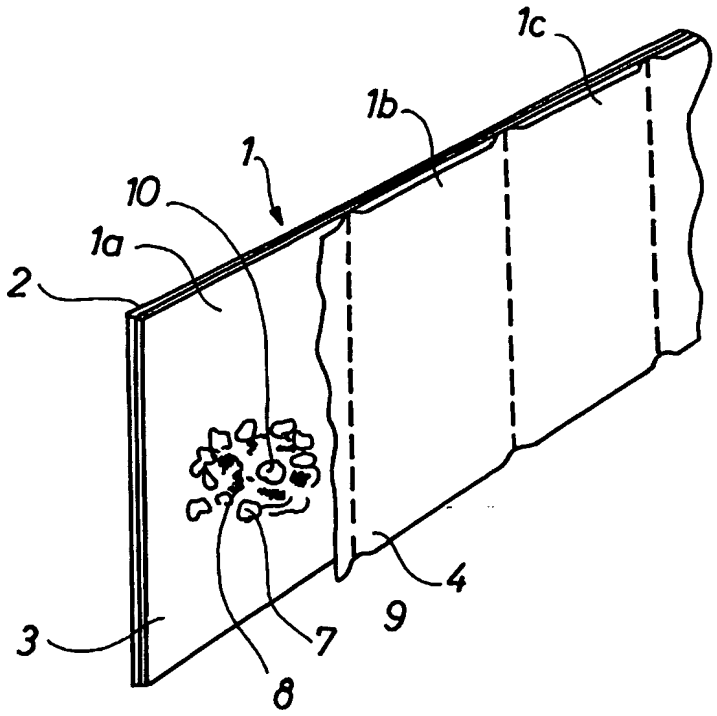
(54) Title: A SEED TAPE INCLUDING SUCCESSIVELY ARRANGED GERMINATING UNITS AS WELL AS A METHOD OF GERMINATING SAID TAPE



(57) Abstract: A seed tape including successively arranged germinating units (1a, 1b, 1c) is made of at least one carrier strip (2) as well as at least one layer (3) of biodegradable, gas-permeable material placed on said carrier strip. Each germinating unit (1a, 1b, 1c) includes a mixture of carrier (7), at least one additive (8) and optionally an adjuvant(s) (9) in addition to one or more seeds (10). The layer (3) of biodegradable, gas-permeable material is flexible and non-woven. The additive or additives (8) are water-absorbing. In this manner the seed tape is particularly suited for being subjected to a pregermination procedure because it possesses a very high capacity of retaining water without disintegrating.

WO 2004/028237 A1

Title: A seed tape including successively arranged germinating units as well as a method of germinating said tape

Technical Field

The invention relates to a seed tape including successively arranged germinating units, and which further includes at least one carrier strip as well as a layer of biodegradable, gas-permeable material arranged on said carrier strip, whereby the layer is optionally locally interrupted a short distance along the seed tape, and whereby each germinating unit includes a mixture of carrier, at least one additive and optionally an adjuvant in addition to one or more seeds, as well as whereby said seed tape is optionally cut into separate germinating units prior to the irrigation and/or the bedding out.

The expression "carrier" should here be understood so as to cover a material including at least one of the substances: granulated, expanded vermiculite, perlite, zeolite, cellulose materials, such as wood fibres and sphagnum burned clay, rock wool or the like substances.

The expression "adjuvant" should here be understood so as to cover one or more substances selected among plant nutrients, plant protectants, such as pesticides, including herbicides, insecticides, especially systemic insecticides, fungicides, virae, cultures of bacteria, cultures of fungi, such as Trichoderma, fungus spores, microencapsulated fungicides, eggs from useful insects, such as predatory nematodes, fertilizers, enzymes, animal repellants, hormones, pH-adjusting agents, carbon, clay particles, trace elements, such as molybdenum, wood fibres or wood powder, kieselguhr, surfactants or other substances with a favourable effect on the germination and the growth of plants, where several substances are available in microencapsulated form.

The expression "biodegradable material" is here to be construed as a material gradually disintegrating when left alone in its natural state so as to be part of the ordinary

biological circuit.

Background Art

One of the most vital conditions for a seed to start germinating is that the enzymes and hormones present in the seed coat are brought into contact with the germ and the white of the seed. This is supported by means of water. When a high number of seeds are moistened with water, the water with the dissolved enzymes and hormones reaches the white and the germ of the individual seeds at a time varying from seed to seed. Accordingly, these seeds start to germinate at various times. Such a developing period is not completely satisfying as nothing but an insignificant time delay with respect to the development of the individual germinating periods implies that the seeds develop into plants which at the harvesting present a rather significant difference in weight.The latter is very disadvantageous for the farmer who wants all plants to be equally developed at the harvesting in such a manner that he or she obtains the best possible yield on the field with the seeds sowed therein. In view of the above a demand applies for the seeds to be subjected to a pregermination procedure whereby additional water is fed in such a manner that all the seeds have developed equally with respect to germination when they are bedded out in the ground.

It is known to pellet seeds in order to provide the seeds with additional nutrition and protection. Frequently, the seed pill includes one or more layers of clay, and it is impossible to incorporate the water reserves necessary for the pregermination into such pills because the clay coat encircling the seeds disintegrates in connection with the feeding thereto of water.

Brief Description of the Invention

The object of the invention is to provide a seed tape of the above type which is suited for being subjected to a germination procedure as described above, and which at the

pregermination procedure is particularly capable of retaining water without disintegrating.

The seed tape according to the invention is characterised in that the layer of biodegradable, gas-permeable material is flexible and non-woven, and that said additive or additives are water-absorbing. As a result, the germinating units are particularly capable of retaining the water amounts necessary for an optimum pregermination procedure. The latter is due to the fact that the materials of the germinating units encircling the seeds can act as a kind of "cocoons" which on the inner side can maintain an optimum moist microclimate around each seed after the watering. This microclimate can compensate for the air or the ground around or at a short distance from the seed tape optionally being less moist during a period. In other words, each "cocoon" provides a moisture buffer function. Even in the moist, viz. swollen, and optionally watered state, the germinating units tolerate considerable stress effects, such as in connection with a maximum bedding out without said germinating units breaking or being weakened and even though radicles or seed leaves should penetrate said germinating units. The flexible non-woven layer is particularly suited for carrying seeds, carrier and adjuvant. The carrier assists in preventing the necessary amount of air from being driven out of each "cocoon" in case of a prolonged uncontrolled supply of water from the surroundings.

According to the invention, the water-absorbing material may be cotton, preferably of a fibre diameter of 19 to 21 µm with the result that a long-term moist microclimate is obtained around each seed in an excellent manner, said climate enhancing the pregermination.

Moreover, when at least one carrier strip is made of paper, preferably of a weight of 14 to 60 g/m^2, preferably 22 g/m^2, the layer of biodegradable, gas-permeable, flexible non-woven material may according to the invention be hot-adhesive, such as made of polylactide (PLA) or materials including said polylactide, or is made of rayon,

viscose or polylactide plus starch.In this manner each germinating unit can form a suitably flexible "cocoon". The carrier, the adjuvant, the water-absorbing additive and the seed can be well adhered inside the "cocoon" in such a manner that no risk applies of said substances accidentally falling out of the seed tape while being handled. The biodegradability is very high as well.

In addition, the biodegradable, gas-permeable, flexible and non-woven material may according to the invention be made of fibres of PLA presenting a slightly creased structure.

According to the invention, the water-absorbing material or materials may be superabsorbing polymers (SAP) present in form of grains or fibres of an average weight of 0.05 to 0.42 mg/grain or fibre. As a result, all the seeds in the seed tape can in a particularly efficient manner be supplied with moisture during a watering procedure so as to provide a moist microclimate around each seed in each germinating unit.

It is particularly advantageous when the SAP-grains or fibres present an average weight of 0.18 to 0.36 mg/grain or fibre, preferably approximately 0.27 mg/grain or fibre.

Moreover, the SAP-grains or fibres may according to the invention be of an average size between 450 and 750 μ, preferably between 550 and 650 μ, especially approximately 600 μ, which turned out to be particularly advantageous.

Furthermore, the carrier strip may according to the invention be made of PLA, such as non-woven PLA.

According to the invention the SAP-grains or fibres may be arranged around and adjacent the seed, said SAP-grains or fibres being retained by means of an adhesive effect resulting from an ultrasound or heat treatment of the non-woven material. In

this manner the seed tape is particularly resistant to disadvantageous stress effects from the outside.

In addition, the non-woven PLA-material may according to the invention present a needle structure and preferably be structured as a sandwich with three crossed layers, where the middle layer includes relatively thin fibres and the two outer layers include fibres being somewhat thicker than the fibres of the middle layer. The resulting non-woven PLA-layer can present a suitable gas-permeability.

According to the invention, the SAP-grains or fibres may be retained adjacent the seed by being glued onto the non-woven material by means of additional glue with the result that the grains or fibres are exceptionally well fastened to the non-woven material.

Moreover, the glue may according to the invention be a biodegradable natural glue, such as a starch, gelatine or sugar-based glue. These types of glue turned out to be particularly advantageous.

Furthermore, at least one of the paper layers may according to the invention be kraft paper, whereas the layer of non-woven PLA may be fastened to the kraft paper by way of spot or line welding, optionally in combination with a local compression of the kraft paper and the PLA layer. Such a seed tape turned out to be particularly strong.

Furthermore, each germinating unit may according to the invention be delimited by two spaced transverse line weldings, whereby at least two relatively short auxiliary weldings may be provided between these line weldings, said auxiliary weldings projecting inwards from each side edge of the seed tape and having a length of 0.05 to 0.20, preferably 0.1 to 0.15, especially 0.12 times the width of the seed tape. As a result, the seed or seeds as well as the mixture of carrier, water-absorbing additive and optionally adjuvant are reliably retained in position inside the "cocoon". In addi-

tion, germ leaves and radicles can easily find a way into the ground, viz. between the auxiliary weldings.

According to the invention, the spot or line weldings may be provided at a temperature of 70 to 110°C when the flexible non-woven layer is PLA. As a result, a suitable adhesiveness is obtained between the PLA and the paper, the seed and the water-absorbing additive, respectively.

According to the invention, the fibres of each non-woven layer may be of a length of 5 to 9 cm, preferably 6 to 8 cm, and a thickness of 0.1 to 0.2 mm. These fibre proportions turned out to be particularly advantageous.

According to the invention, the water-absorbing additive may be silica particles, which turned out to be particularly advantageous.

Moreover, the biodegradable, gas-permeable, flexible non-woven layer may according to the invention be formed by a row of pockets of non-woven polylactide (PLA) fastened to the carrier strip at an equidistant distance, and where each pocket includes a seed, which turned out to be particularly advantageous as well.

According to the invention, at least one thin separating layer of biodegradable film is placed in parallel to the biodegradable flexible non-woven layer, said thin separating layer optionally being a semi-permeable film, preferably of PLA, gelatine or cellulose (cellophane^{TR}) and preferably of a thickness of 20 to 75 µm, especially 30 to 50 µm. In this manner a time-limited separation between the seed or seeds on one hand and on the other hand the adjuvant or adjuvants is rendered possible which can be relevant in connection with some plant protectants, such as pesticides.

Moreover, when the seeds are preferably sugar beet seeds, each germinating unit may according to the invention be delimited by a circumferential welded seam, which

optionally is locally interrupted in order to provide openings allowing radicles and seedlings to penetrate therethrough. This embodiment is particularly suited in connection with an accurate seeding.

According to the invention, the mixture of carrier, water-absorbing additive and optionally adjuvant may be compressed into a small piece, which can optionally also include the seed or the seeds, whereby a particularly easy handling of these materials is obtained.

Moreover, the adjuvant, such as pesticides, may according to the invention be available in a small capsule in each germinating unit, whereby a particularly easy administration of the pesticide is obtained.

Furthermore, each piece may according to the invention be constituted by a sandwich, which is delimited by a layer of non-woven PLA on the outside and which on the inside contains the carrier, the adjuvant and the water-absorbing additive, said piece for instance being dimensioned substantially as a stamp, whereby a particularly simple piece is obtained.

According to the invention, the flexible non-woven PLA-layer may advantageously present a suction capacity of 0 to 30 mm, for instance 5 to 15 mm with the result that the PLA-layer can present a suitable wick effect.

In addition, the paper carrier strip may according to the invention also include fibres of PLA, preferably of a fibre length of 4 to 7 mm, which highly reinforces the paper carrier strip and renders said strip suited for being hot-glued onto other layers.

According to the invention, the water-absorbing additive or additives, such as SAP and optionally adjuvants, may be absorbed in or adhered to a blotting paper piece optionally provided with a plastic coating, such as a PLA coating, for a slow release of the

additive and/or the adjuvant, said blotting paper piece being placed inside each germinating unit and for instance resulting from a cutting off from a high speed produced roll of blotting paper, such as at 500 m/min, where the above water-absorbing additive and adjuvant, if any, is sucked into or glued onto said blotting paper. In this manner the additive and the adjuvant, if any, can be administered in a very simple manner in each germinating unit because no more than one piece need be inserted in each germinating unit. These pieces are also cost-effective due to a very rational manufacture.

The invention relates also to a method of pregerminating the seed tape according to the invention, and where the additives include superabsorbing polymers (SAP). This method is characterised in that the seed tape is subjected to a watering during an initial phase until it has absorbed an amount of water corresponding to maximum 80% of the weight of the dry seed tape, the water temperature being kept at approximately 11 to 30 °C, the pH of the water being kept at 4.5 to 7.5, such as by means of phosphoric acid, and the electric conducting values of the water being adjusted by means of nutritive salts, such as potassium nitrate, to the desired preferably 0.8 to 3.0 µS, especially 1.1 to 1.9 µS, whereafter the seed tape is placed in a growth chamber for a reaction period of 6 to 150 hours. During a predetermined period the SAP-grains absorb a predetermined quantity of the water supplied, whereby, however, the absorbing capacity is determined by the concentration of salt in the liquid supplied, said concentration of salt being expressed by means of the electric conducting values. Although the seeds are rather different with respect to stage of development, these seeds are allowed to develop to more or less the same stage of development during the reaction period, i.e. the stage of development immediately after the water with the enzymes and the hormones of the seed coat has penetrated into the live portion of the seed. However, as only a limited amount of water is available at each seed, the pregermination procedure is delayed, because the germination cannot proceed until additional water is supplied.

Moreover, the seed tape may according to the invention immediately following the

germination be subjected to an X-ray scanning, whereafter the germinating units unsuited for a bedding out are discarded on the basis of the X-ray scanning result. In this manner it is possible before the bedding out of the germinating units to see whether a germinating unit has not developed sufficiently and should accordingly be discarded.

Finally, the germinating units of the seed tape may according to the invention be separated prior to the bedding out, such as by being subjected to a heat cutting of the carrier strip. As a result, the germinating units can be bedded out completely independently in response to the demand.

Brief Description of the Drawing

The invention is explained in detail below with reference to the drawing, in which

Fig. 1 is a perspective view of an embodiment of the seed tape according to the invention,

Fig. 2 is a perspective view of a portion of a second embodiment of the seed tape,

Fig. 3 is a front view of a portion of a third embodiment of the seed tape,

Fig. 4 is a cross sectional view of an embodiment of the seed tape including separating layers,

Fig. 5 is a front view of a portion of a fourth embodiment of the seed tape,

Fig. 6 is a perspective view of a piece according to the invention,

Fig. 7 is a perspective view of a capsule according to the invention,

Fig. 8 is a perspective view of a piece according to the invention structured as a sandwich,

Fig. 9 is a perspective view of a blotting paper piece according to the invention, and

Fig. 10 illustrates a diagram showing the important steps of a method of germinating the seed tape according to the invention.

Best Mode for Carrying Out the Invention

The seed tape of Fig. 1 includes many successively arranged germinating units, only three germinating units 1a, 1b og 1c being shown. The seed tape includes at least a biodegradable carrier strip 2 as well as at least one layer 3 of biodegradable gas-permeable material arranged on said strip. An additional carrier strip is indicated at 4. The layer 3 can be locally interrupted over a short distance along the seed tape, which, however, has not been illustrated. Each germinating unit 1a, 1b, 1c includes a mixture of carrier 7 and at least one water-absorbing additive 8 in addition to one or more seeds 10. One or more adjuvants 9 can also be present. Each carrier 7 and each adjuvant 9 includes at least one of the substances described above.

The water-absorbing additive or additives 8 can for instance be cotton, preferably a cotton of a fibre diameter of 19 to 21 μ.

The layer 3 of biodegradable, gas-permeable material is flexible and non-woven. It can be hot-adhesive and for instance be made of polylactide (PLA) or a material containing said PLA or be made of rayon, viscose or polylactide plus starch. The layer 3 can be a non-woven material made of PLA-fibres with a slightly creased structure. The carrier strip 2 can be made of paper and preferably be of a weight of 14 to 60 g/m^2, preferably 22 g/m^2. However, the carrier strip can also be made of PLA, such as non-woven PLA.

The water-absorbing additive or additives 8 can be superabsorbing polymers (SAP) present in form of grains or fibres of an average weight of 0.05 to 0.42 mg/grain or fibre. In Fig. 1, these SAP-grains 8 have been illustrated in an exaggerated size for the sake of clarity of the Figure. The SAP-grains can for instance be cross-linked polyacrylic acid salts, cross-linked isobutylene-maleic acid-copolymer derivatives, salts of cross-linked starch-polyacrylic acid, salts of cross-linked polyvinyl-alcohol-polyacrylic acid, cross-linked polyvinylalcohol derivatives, cross-linked polyethylene-glycol derivatives and cross-linked carboxymethylcellulose derivatives.

The SAP-grains or fibres 8 can be of an average weight of 0.18 to 0.36 mg/grain or fibre, preferably approximately 0.27 mg/grain or fibre. It is also possible that the SAP-grains or fibres 8 are of an average size, viz. "diameter", of between 450 and 750 µ, preferably between 550 and 650 µ, especially approximately 600 µ.

The SAP-grains or fibres 8 can be arranged around and adjacent the seed 10, said SAP-grains or fibres being retained by means of an adhesive effect resulting from an ultrasound or heat treatment of the PLA material.

The non-woven PLA-material 3 can present a needle structure and preferably be structured as a sandwich not shown with three crossed PLA-fibre layers, where the middle layer includes relatively thin fibres and the two outer layers include fibres being somewhat thicker than the fibres of the middle layer. The fibres of each layer are arbitrarily arranged relative to one another.

The SAP-grains or fibres 8 can be retained adjacent the seed by being glued onto the non-woven material 3 by means of additional glue. However, this glue does not appear from the Figure.

The glue can be a biodegradable natural glue, such as a starch, gelatine or sugar-based glue.

In Fig. 1, the strip 2 can for instance be kraft paper, whereas the layer 3 can be made of non-woven PLA as mentioned above, and a paper layer 4 can be placed on said layer 3. The layers can be fastened to one another by way of spot or line welding, optionally in combination with a local compression of the kraft paper and the PLA-layer.

As shown in Fig. 3, each germinating unit can be delimited by two spaced transverse spot or line weldings 16, and at least two relatively short auxiliary weldings 17 can be provided between said spot or line weldings. These auxiliary weldings 17 project inwards from each side edge 18 of the seed tape and are of a length a of 0.05 to 0.20, preferably 0.1 to 0.15, especially 0.12 times the width b of the seed tape.

When the flexible non-woven layer 3 is made of PLA, the spot or line weldings 16 can be provided at a temperature of 70 to 110°C.

The fibres of the non-woven layer 3 can be of a length of 5 to 9 cm, preferably 6 to 8 cm, and a thickness of 0.1 to 0.2 mm.

The water-absorbing material 8 can be made of silica particles instead of the above SAP-grains or fibres.

As shown in Fig. 2, the seed tape can include a carrier strip 2', and the biodegradable, gas-permeable non-woven layer can be fastened to said carrier strip in form of a row of pockets 3' of non-woven polylactide (PLA), said pockets preferably being arranged at an euqidistant distance.

The flexible non-woven PLA-layer 3 can have a weight of 10 to 40 g/m^2, preferably 14 to 25 g/m^2, especially 22 g/m^2. The paper strip 2 can include fibres of PLA, preferably of a fibre length of 4 to 7 mm.

As shown in Fig. 4, at least one thin separating layer 20 of biodegradable film can be placed in parallel to the biodegradable flexible non-woven layer 3, said thin separating layer optionally being a semi-permeable film, preferably of PLA, gelatine or cellulose (cellophane^{TR}) and preferably of a thickness of 20 to 75 μm, especially 30 to 50 μm. Thus the separating layers 20 separate the carrier, the adjuvant and the water-absorbing additive. As the separating layers are gradually disintegrated, the above materials are released.

When the seeds are sugar beet seeds, each germinating unit can be delimited by a circumferential welded seam 26, cf. Fig. 5, which is optionally locally interrupted in order to provide openings 27 allowing radicles and seedlings to penetrate from each seed.

As shown in Fig. 6, the mixture of carrier 7, water-absorbing additive 8 and optionally adjuvant 9 can be compressed into a small piece 21 which, if desired, can also include the seed or the seeds 10.

The pieces 21 can be provided by placing paper pulp, SAP-crystals and grains of carrier 7 and adjuvant 9 by means of air on for instance the prepunched surface of a suction cylinder not shown.

The adjuvant 9, such as pesticides, can, if desired, be placed in a small closed capsule 22, cf. Fig. 7, inserted in each germinating unit in order to allow a "slow release" of said pesticides.

In addition, each piece 23 can be constituted by a sandwich, cf. Fig. 8, which is delimited by layers 25a, 25b of non-woven PLA on the outside and which on the inside contains the carrier 7, the adjuvant 9 and the water-absorbing additive 8 optionally in connection with the separating layers 29, said piece for instance being dimensioned substantially as a stamp.

The flexible non-woven PLA-layer 3 in the germinating unit 1a, 1b, 1c can present a suction capacity of 0 to 30 mm, for instance 5 to 15 mm, estimated according to the method indicated in H.J. Hannover and Sigurd Smith: Papirfabrikation ("Production of Paper") Julius Gjellerups Forlag 1934, page 277. The suction capacity is the height measured in mm to which said layer 3 can suck the water in 10 min, the layer 3 being present as a vertically suspended strip of the layer 3.

Furthermore it is possible that the water-absorbing additive or additives 8, such as SAP, and optionally adjuvants 9, such as pesticides, can be absorbed in or adhered to a blotting paper piece optionally provided with a plastic coating, such as a PLA-coating, for a "slow release" of additive 8 and/or adjuvant 9. This blotting paper piece can be placed inside each germinating unit 1a, 1b, 1c, cf. Fig. 1, and for instance result from a cutting off from a high speed produced roll of blotting paper, such as at 500 m/min, where the above water-absorbing additive and adjuvant, if any, is sucked into or glued onto said blotting paper.

Fig. 10 is a diagrammatic view of the steps necessary for carrying out the method according to the invention. The method deals with a watering of a seed tape which is to be subjected to a pregermination, and which includes inter alia additives in form of superabsorbing polymeric grains (SAP) in addition to the seeds. The method is particularly suited for seed tapes including superabsorbing polymeric grains, optionally short polymeric fibres, of an average weight of 0.05 to 0.42 mg/grain or fibre. However, the method can also be used for other types of seed tapes. The method is carried out by the seed tape being watered in an initial phase until it has absorbed an amount of water corresponding to maximum 80% of the weight of the dry seed tape, this step of the method being indicated at 12. During the watering, the water temperature is kept at approximately 11 to 30° and the pH of the water at 4.5 to 7,5, for instance by an addition of phosphoric acid; the electric conducting values of the water are adjusted by means of nutritive salts, such as potassium nitrate, in such a manner that said electric conducting values of the water are in the range of 1.5 to 1.9 mS

(microsiemens). After the step 12, the seed tape is placed in a growth chamber for a reaction period of 6 to 200 hours, preferably 12 to 120 hours, especially 18 to 100 hours. When the seed 10 is a Brassica seed (cabbage), the reaction period is in the interval of approximately 20 to 75 hours. When the seed 10 is a Lactuca Sativa seed (lettuce), the reaction period is in the interval of approximately 10 to 45 hours. When the seed is a Spinacia oleracea (spinach) seed, a reaction period of 24 to 72 hours is necessary.

After the stay in the growth chamber, the seed tape can be watered until it has absorbed an amount of water corresponding to at least 50% of its weight in dry state, which has been indicated in step 14. Such a processing implies, that the seed tape starts to germinate, and quickly the seed is completely germinated and ready for being bedded out in the ground. Before the bedding out procedure is started, the individual germinating units 1a, 1b, 1c can be separated, such as by the seed tape 1 being subjected to a cutting.

In order to ensure that each germinating unit in the seed tape 1 has been correctly pregerminated, it is possible immediately after said germination to carry out an X-ray scanning of said seed tape. Subsequently, it is possible on the basis of the X-ray scanning results to discard the germinating units unsuited for being bedded out after the germination of the seed tape. In other words, the germinating units not sufficiently developed, i.e. pregerminated, can be discarded. Ordinarily, a very small proportion of the germinating units are discarded. Accordingly, these discarded germinating units are not bedded out together with the remaining germinating units in the seed tape.

The invention may be modified in many ways without thereby deviating from the scope of the invention, as it appears from the attached claims. Thus, the strip 4 in the seed tape 1 can be replaced by a coating, which is placed for instance on top of the non-woven layer 3, whereby the seed 10, the carrier 7, the adjuvant 9 and the additive

8 are then retained against the layer 3 by said coating. The latter option is, however, not shown.

It should be noted that the seed tape according to the invention has nothing to do with covering materials or strips containing seeds and adjuvants, and which are intended to be placed on the bare surface of the ground, especially in areas suffering from difficult growth conditions. As far as the seed tape according to the invention or portions thereof is concerned the seed tape or seed tapes are placed either horizontally or vertically at a suitable depth below the surface of the ground.

The flexible non-woven layer 3 of biodegradable, gas-permeable material can also be a polymer, for instance a polyester or another oil-based polymer; it can optionally be an aliphatic-aromatic polycondensation copolymer derived from dipidic terephtalic acid and butanediol.

Claims

1. A seed tape (1) including successively arranged germinating units (1a, 1b, 1c), and which further includes at least one carrier strip (2, 4) as well as at least one layer (3) of biodegradable, gas-permeable material arranged on said carrier strip, whereby the layer (3) is optionally locally interrupted a short distance along the seed tape, and whereby each germinating unit (1a, 1b, 1c) includes a mixture of carrier (7), at least one additive (8) and optionally an adjuvant (9) in addition to one or more seeds (10), as well as whereby said seed tape is optionally cut into separate germinating units prior to the irrigation and/or the bedding out, c h a r a c t e r i s e d in that the layer (3) of biodegradable, gas-permeable material is flexible and non-woven, and that said additive or additives (8) is/are water-absorbing.

2. A seed tape as claimed in claim 1, c h a r a c t e r i s e d in that the water-absorbing material (8) is cotton, preferably of a fibre diameter of 19 to 21 µ.

3. A seed tape as claimed in claim 1, where the above at least one carrier strip (2, 4) is made of paper preferably of a weight of 14 to 60 g/m^2, c h a r a c t e r i s e d in that the layer of biodegradable, gas-permeable, flexible, non-woven fabric material (3) is hot-adhesive, such as made of polylactide (PLA) or a material including said polylactide, or is made of rayon, viscose or polylactide plus starch.

4. A seed tape as claimed in claim 1 or 3, c h a r a c t e r i s e d in that the biodegradable, gas-permeable, flexible and non-woven material (3) is made of fibres of PLA presenting a slightly creased structure.

5. A seed tape as claimed in claim 1, c h a r a c t e r i s e d in that the water-absorbing materials (8) are superabsorbing polymers (SAP) present in form of grains or fibres of an average weight of 0.05 to 0.42 mg/grain or fibre.

6. A seed tape as claimed in claim 5, characterised in that the SAP grains or SAP fibres (8) are of an average weight of 0.18 to 0.36 mg/grain or fibre, preferably approximately 0.27 mg/grain or fibre.

7. A seed tape as claimed in claim 5 or 6, characterised in that the SAP grains or SAP fibres (8) are of an average size between 450 and 750 µ, preferably between 550 and 650 µ, especially approximately 600 µ.

8. A seed tape as claimed in one or more of the claims 1, 3 and 7, characterised in that the SAP grains or SAP fibres (8) are arranged around and adjacent the seed (10), said SAP grains or SAP fibres being retained by means of an adhesive effect resulting from an ultrasound or heat treatment of the non-woven material.

9. A seed tape as claimed in claim 1, characterised in that the carrier strip (2, 4) is made of PLA, such as non-woven PLA.

10. A seed tape as claimed in one or more of the claims 3, 4, 8 or 9, characterised in that the non-woven PLA material (3) presents a needle structure and is preferably structured as a sandwich with three crossed layers, where the middle layer includes relatively thin fibres and the two outer layers include fibres being thicker than the fibres of the middle layer.

11. A seed tape as claimed in one or more of the claims 5 to 8, characterised in that the SAP grains or the SAP fibres (8) are retained adjacent the seed (10) by being glued onto the non-woven layer (3) by means of additional glue.

12. A seed tape as claimed in claim 11, characterised in that the glue is a biodegradable natural glue, such as a starch, gelatine or sugar-based glue.

13. A seed tape as claimed in one or more of the claims 3 to 12, character-

i s e d in that at least one of the paper layers (2, 4) is kraft paper, and that the layer (3) of non-woven PLA is fastened to the kraft paper by way of spot or line welding optionally in combination with a local compression of said kraft paper and said PLA-layer.

14. A seed tape as claimed in one or more of the claims 1 to 13, c h a r a c t e r - i s e d in that each germinating unit (1a, 1b, 1c) is delimited by two spaced transverse spot or line weldings (16), and that at least two relatively short auxiliary weldings (17) are provided between the spot or line weldings (16), said auxiliary weldings projecting inwards from the side edges (18) of each seed tape and being of a length (a) of 0.05 to 0.20, preferably 0.1 to 0.15, especially 0.12 times the width (b) of the seed tape.

15. A seed tape as claimed in claim 14, where the flexible non-woven layer (3) is PLA, c h a r a c t e r i s e d in that the spot or line weldings are provided at a temperature of 70 to 110°C.

16. A seed tape as claimed in one or more of the claims 3 to 11, c h a r a c t e r - i s e d in that the fibres of each non-woven layer (3) is of a length of 5 to 9 cm, preferably 6 to 8 cm, and a thickness of 0.1 to 0.2 mm.

17. A seed tape as claimed in claim 1, c h a r a c t e r i s e d in that the water-absorbing additive (8) is silica particles.

18. A seed tape as claimed in one or more of the claims 1 to 17, c h a r a c t e r - i s e d in that the biodegradable, gas-permeable, flexible, non-woven layer (3) is formed by a row of pockets (3') of non-woven polylactide (PLA) fastened to the carrier strip (2') at an equidistant distance, and where each pocket includes a seed.

19. A seed tape as claimed in any of the preceding claims, c h a r a c t e r i s e d in

that the flexible non-woven PLA layer (3) is of a weight of 10 to 40 g/m^2, preferably 14 to 25 g/m^2, especially 22 g/m^2.

20. A seed tape as claimed in one or more of the claims 1 to 19, c h a r a c t e r i s e d in that at least one thin separating layer (20) and biodegradable film can be placed in parallel to the biodegradable flexible non-woven layer (3), said thin separating layer optionally being a semi-permeable film, preferably of PLA, gelatine or cellulose (cellophane^{TR}) and preferably of a thickness of 20 to 75 µm, especially 30 to 50 µm.

21. A seed tape as claimed in claim 13, and where the seeds are preferably sugar beet seeds, c h a r a c t e r i s e d in that each germinating unit (1a, 1b, 1c) is delimited by a circumferential welded seam (26), which is optionally locally interrupted in order to provide the opening (27) through which radicles and seedlings can advance.

22. A seed tape as claimed in one or more of the claims 1 to 21, c h a r a c t e r i s e d in that the mixture of carrier (7), water-absorbing additive (8) and optionally adjuvant (9) is available as a compressed small piece which optionally also includes the seed or seeds (10).

23. A seed tape as claimed in one or more of the claims 1 to 22, c h a r a c t e r i s e d in that that the pieces (21) are produced by placing paper pulp, optionally cellulose fibres, SAP-crystals (8) and grains of carrier (7) and adjuvants (9) for instance on the surface of a suction cylinder by means of air.

24. A seed tape as claimed in claim 22, c h a r a c t e r i s e d in that the adjuvants (9), such as pesticides, are placed in a small capsule (22) in each germinating unit (1a, 1b, 1c).

25. A seed tape as claimed in one or more of the claims 1 to 22, characterised in that each piece is constituted by a sandwich (23), which is delimited by layers (25a, 25b) of non-woven PLA on the outside and which on the inside contains the carrier (7), the adjuvant (9) and the water-absorbing additive (8) optionally in connection with the separating layers (29), said piece for instance being dimensioned substantially as a stamp.

26. A seed tape as claimed in any of the preceding claims, characterised in that the flexible non-woven PLA-layer (3) presents a suction capacity of 0 to 30 mm, for instance 5 to 15 mm.

27. A seed tape as claimed in claim 1, characterised in that the water-absorbing additive or additives (8), such as SAP, and optionally adjuvants (9), such as pesticides, can be absorbed in or adhered to a blotting paper piece (27) optionally provided with a plastic coating, such as a PLA-coating, for a slow release of additive and/or adjuvant, said blotting paper piece (27) being placed inside each germinating unit (1a, 1b, 1c) and for instance result from a cutting off from a high speed produced roll of blotting paper, such as at 500 m/min, where the above water-absorbing additive (8) and adjuvant (9), if any, are sucked into or glued onto said blotting paper piece.

28. A method of pregerminating seed tapes as claimed in one or more of the claims 1 to 27, and where the additives include superabsorbing polymers (SAP), characterised in that the seed tape (1) is subjected to a watering during an initial phase until it has absorbed an amount of water corresponding to maximum 80% of the weight of the dry seed tape, the water temperature being kept at approximately 11 to 30°C, the pH of the water being kept at 4.5 to 7.5, such as by means of phosphoric acid, and the electric conducting values of the water being adjusted by means of nutritive salts, such as potassium nitrate, and that the seed tape is subsequently placed in a growth chamber for a reaction period of 6 to 150 hours.

29. A method as claimed in claim 28, c h a r a c t e r i s e d in that immediately following the pregermination, the seed tape is subjected to an X-ray scanning, whereafter the germinating units unsuited for a bedding out are discarded on the basis of the scanning result.

30. A method as claimed in claim 28 or 29, c h a r a c t e r i s e d in that the germinating units (1', 2', 3') of the seed tape are separated prior to the bedding out, such as by being subjected to a cutting.

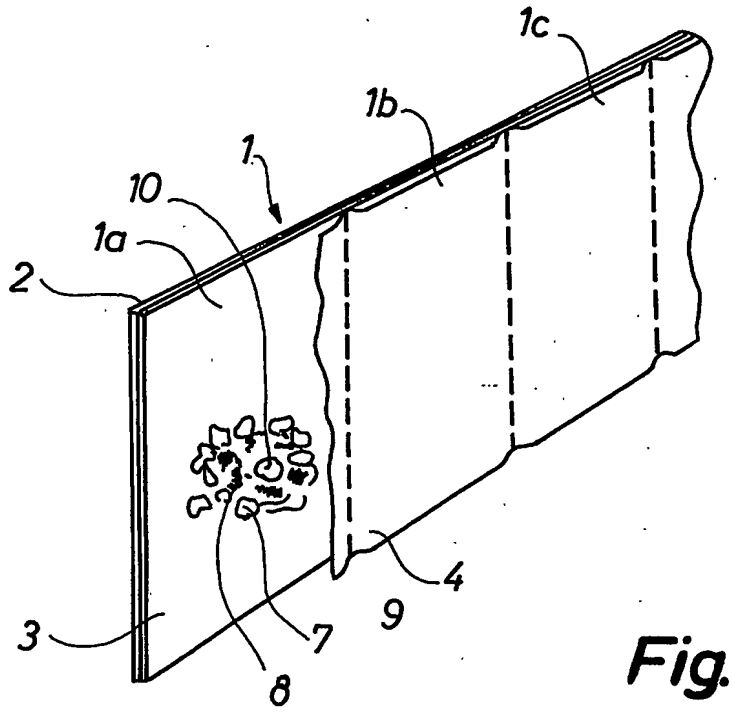


Fig. 1

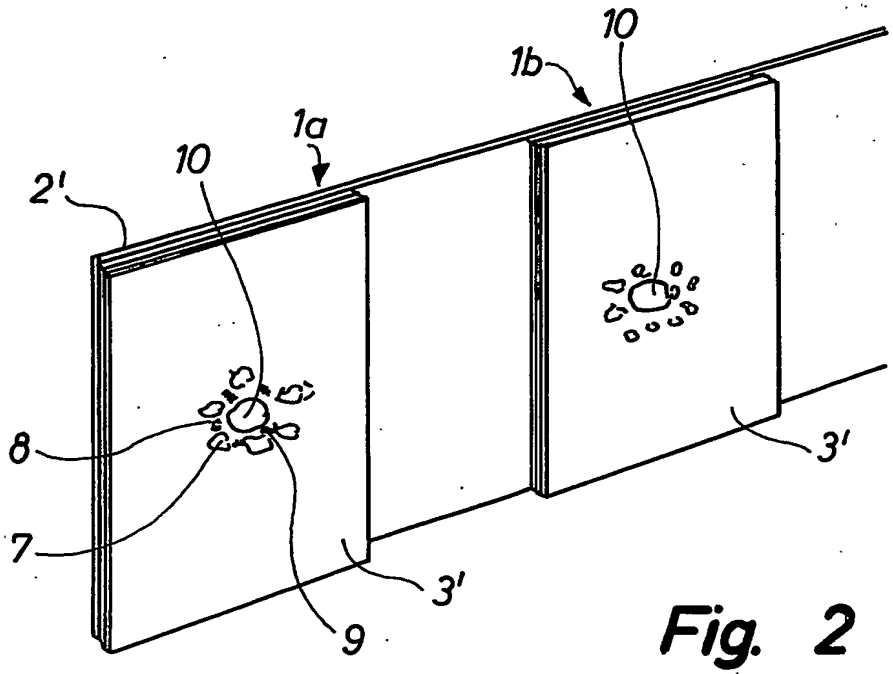


Fig. 2

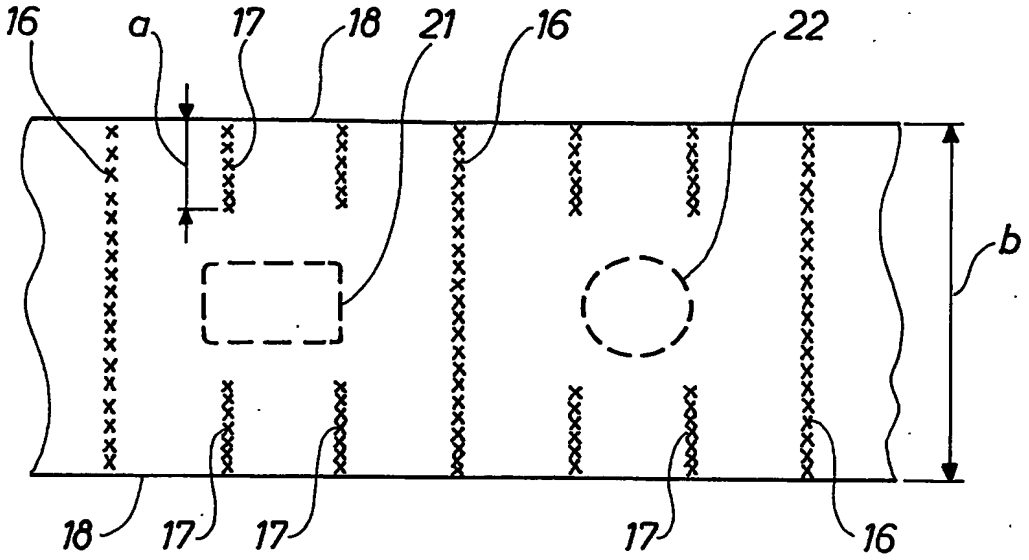


Fig. 3

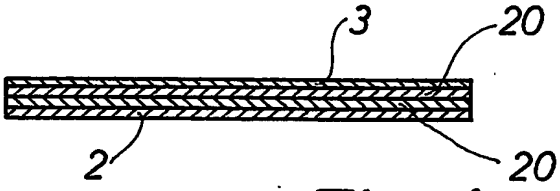


Fig. 4

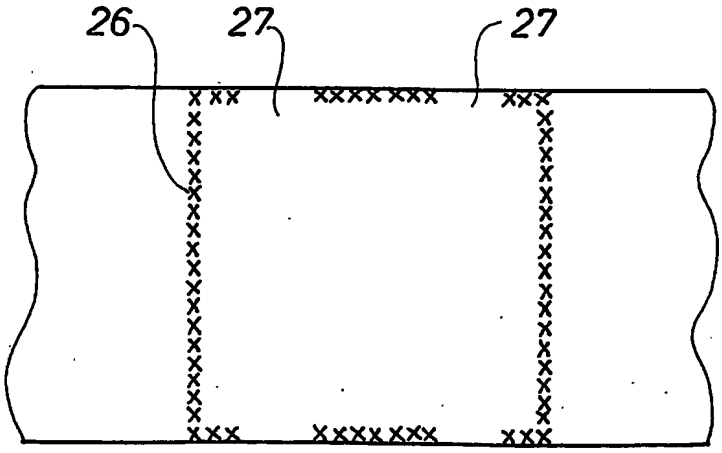


Fig. 5

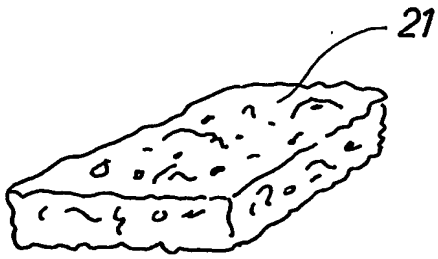


Fig. 6

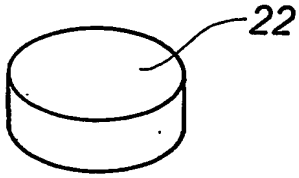


Fig. 7

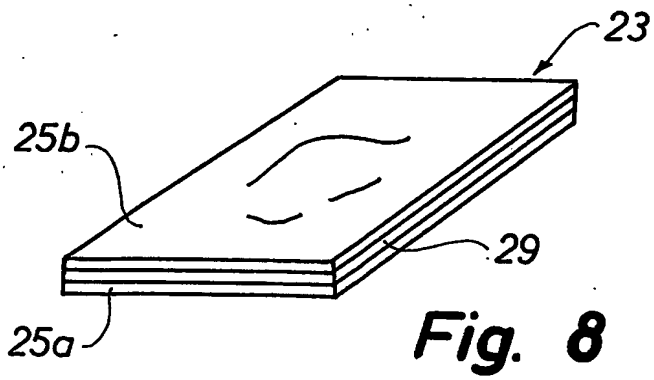


Fig. 8

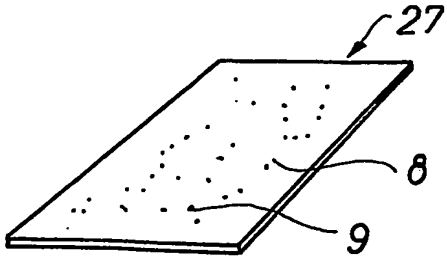


Fig. 9

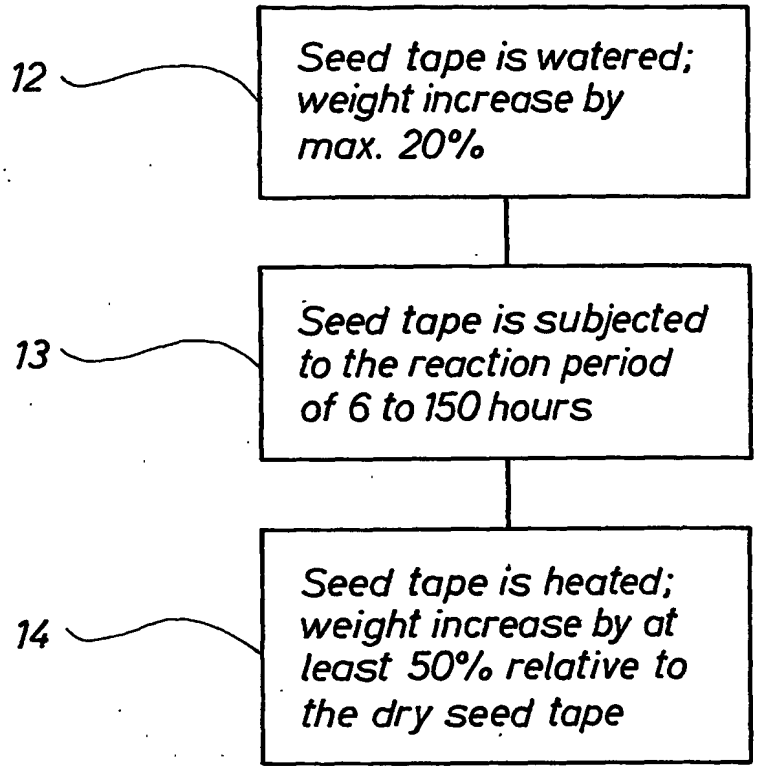

12
Seed tape is watered; weight increase by max. 20%
13
Seed tape is subjected to the reaction period of 6 to 150 hours
14
Seed tape is heated; weight increase by at least 50% relative to the dry seed tape

Fig. 10

INTERNATIONAL SEARCH REPORT

International Application No
PCT/DK 02/00632

A. CLASSIFICATION OF SUBJECT MATTER
IPC.7 A01C1/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A01C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01 56361 A (BENTLE PRODUCTS AG ;AHM POUL HENRIK (ES)) 9 August 2001 (2001-08-09) page 3, line 23 -page 4, line 2 page 5, line 10 - line 15 abstract; claim 2	1,17
A	---	2-16, 18-30
A	US 5 226 255 A (ROBERTSON DAVID W) 13 July 1993 (1993-07-13) abstract	1-30

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 May 2003	27 05. 2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	INGRID FALK/JA A

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/DK 02/00632

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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